Fires & Composting

Photo Source (PS): Richard Buggeln

Causes of fires-- “Surface” fires:

- Lightening strikes
- Heat from equipment
- Sparks from welding
- Cigarette butts (?)
- Wildfires
- Arson

Spontaneous Combustion (SC):

- Common cause of fires at compost facilities
- No external energy/spark needed
- Result of chain reaction of several heat-generating processes

How to Build a Spontaneous Combustion Pile:

1. Build a large pile of biologically active materials (13 - 15 ft or 4m high)
2. Use materials that are relatively dry but not too dry (20% to 40% MC),

   (OR allow a section of a moist pile to dry below 40%)
3. Leave pile undisturbed for weeks
4. Wait

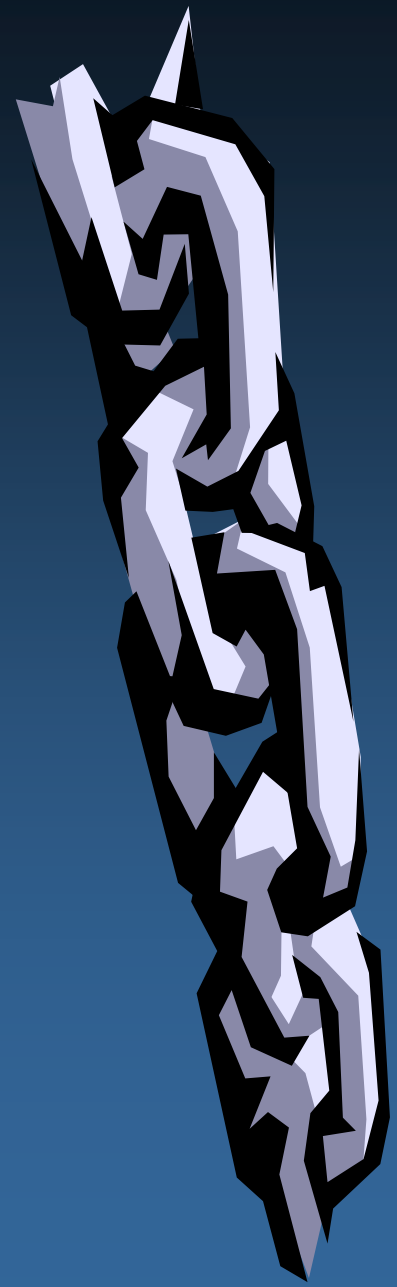
Enhancing Your Spontaneous Combustion Experience:

1. Include feedstocks that are at an early stage of decomposition (but not soaking wet)
2. Add plant materials abundant in oils (e.g. eucalyptus)
3. Maintain the exterior in a dry well-insulating state
4. Limit aeration, or promote air channeling with pockets of dead space in between
5. Occasionally add water, but too much, and not evenly
6. Don’t touch that pile! … Leave it be
7. When good and hot – smoldering – open it up (or add aeration or wind)

Accelerating Chain Reaction

1) Biological self-heating
   - reaches 70-80^{o}C (160-185^{o}F)

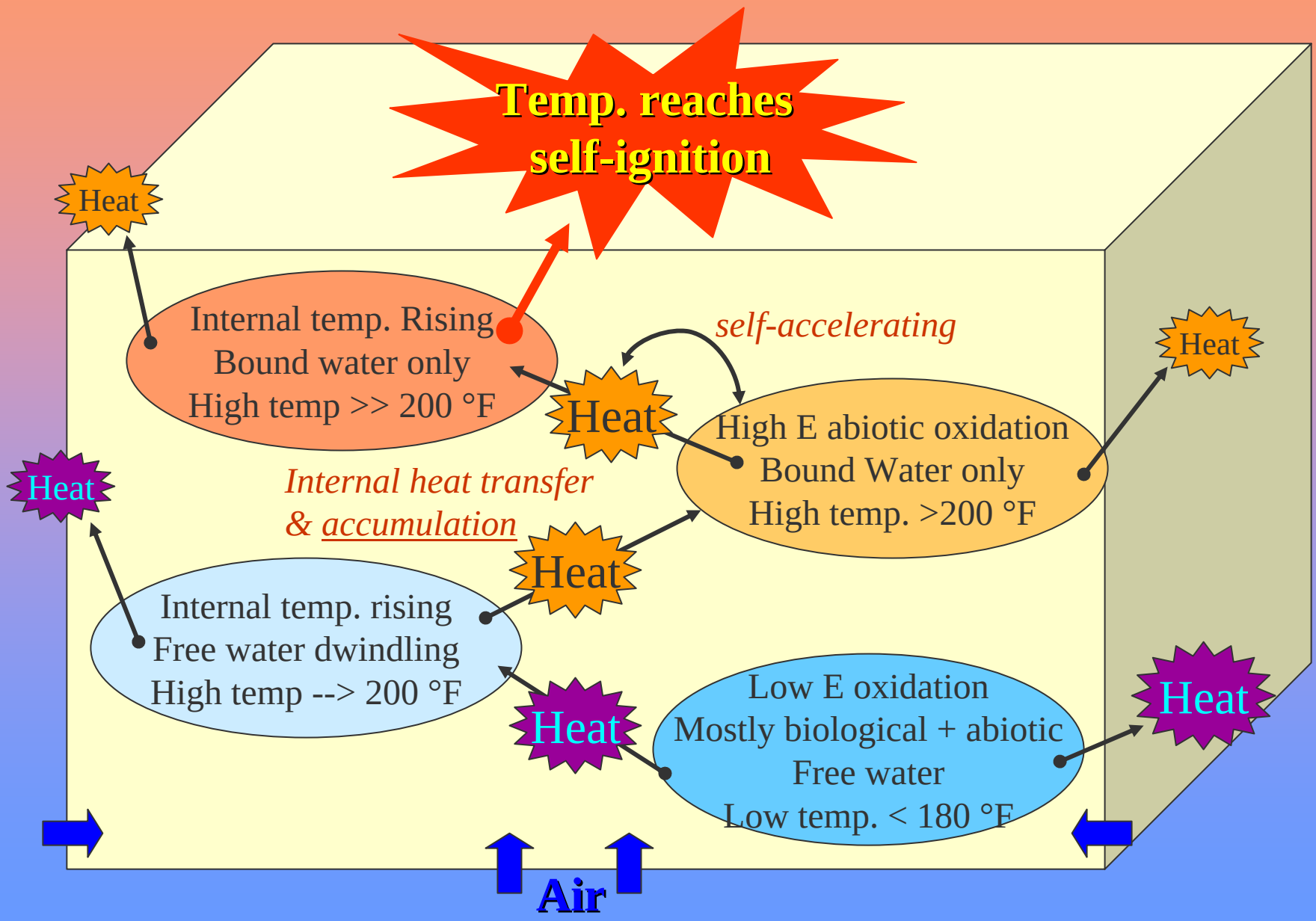
2) Chemical reactions release heat
   - pyrolysis, adsorption, condensation, chemical oxidation
   - bridges gap between biological self-heating and ignition point



Chain reaction continued

Ignition

- 150-200^{o}C (300-400^{o}F)
- limited oxygen--**smoldering fire**
- add oxygen--***flaming fire***


Temp. reaches self-ignition
Heat
Internal temp. Rising
Bound water only
High temp >> 200 °F
self-accelerating
Heat
High E abiotic oxidation
Bound Water only
High temp. >200 °F
Heat
Heat
Internal heat transfer
& accumulation
Heat
Internal temp. rising
Free water dwindling
High temp --> 200 °F
Heat
Low E oxidation
Mostly biological + abiotic
Free water
Low temp. < 180 °F
Heat
Air

Environmental Factors

- Precipitation
- Humidity
- Wind
- Weather changes (e.g. front)
- Ambient temperature
- Spark

Moisture -- The Governor

+ + + +

- Stimulates microbial activity
- Catalyzes abiotic oxidation
- Contributes heat of condensation
- Transfers heat

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- Removes & regulates heat by evaporation
- Limits temp. to 212°F (100 C)
- Interferes w/ air flow & oxygen transfer
- Increases conduction

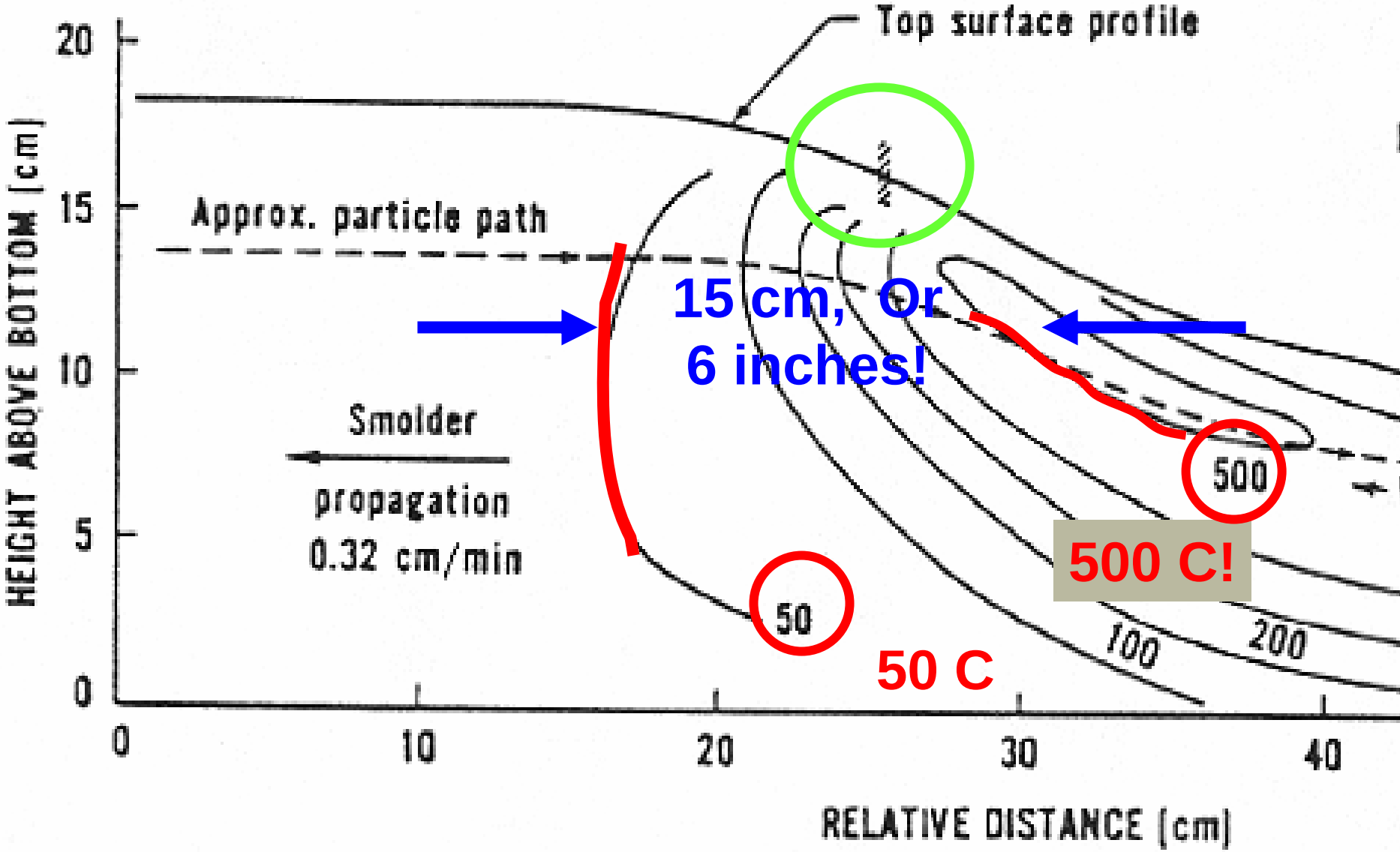
Top surface profile
Approx. particle path
15 cm, Or
6 inches!
Smolder
propagation
0.32 cm/min
500
500 C!
50
50 C
100
200
HEIGHT ABOVE BOTTOM (cm)
RELATIVE DISTANCE (cm)
0
5
10
15
20
0
10
20
30
40

Photo Source (PS):
Richard Buggeln

Photo Source (PS): Richard Buggeln


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Question: **When a pile fire develops, and the Fire Department is called and arrives on the scene, who is in charge?**

Answer: **The law says the Fire Department is in charge of dealing with fires.**

Photo Source: Fred Michel

Fighting Spontaneous Combustion Fires

- Large amounts of water

INEFFECTIVE!

- Remove cooler outside material first
- Remove, Spread, Douse

Photo Source: Fred Michel

Conclusion: Facility operators should meet with the Fire Department in advance

-- make sure they (and you) understand how to deal with fires at your facility

-- understand your materials and feedstocks

It’s not necessarily SC.

Fire Prevention & Preparation

- Prevention: monitor site, temperatures, look for signs (steam vents)
- Preparation: site design, fire response kit, emergency plan (PPC Plan)

- Fighting surface fires
  - accessible
  - traditional water & chemical application

Photo Source: Matt Cotton

Fires: Site Design Implications

- Provide enough space to avoid exceeding the fire-safe height of piles.
- Provide access to piles for fire fighting equipment (full perimeter access).
- Provide access to adequate supply of water.
- Provide space to spread piles out if a SC fire should start

DONE

Questions?

Odor Management

PS: Tom Richard

Odor Management

- You will spend more time addressing odors than any other nuisance problem
- You will worry about odors more than anything else … (except money)
- Odor control and management is critical, crucial, essential

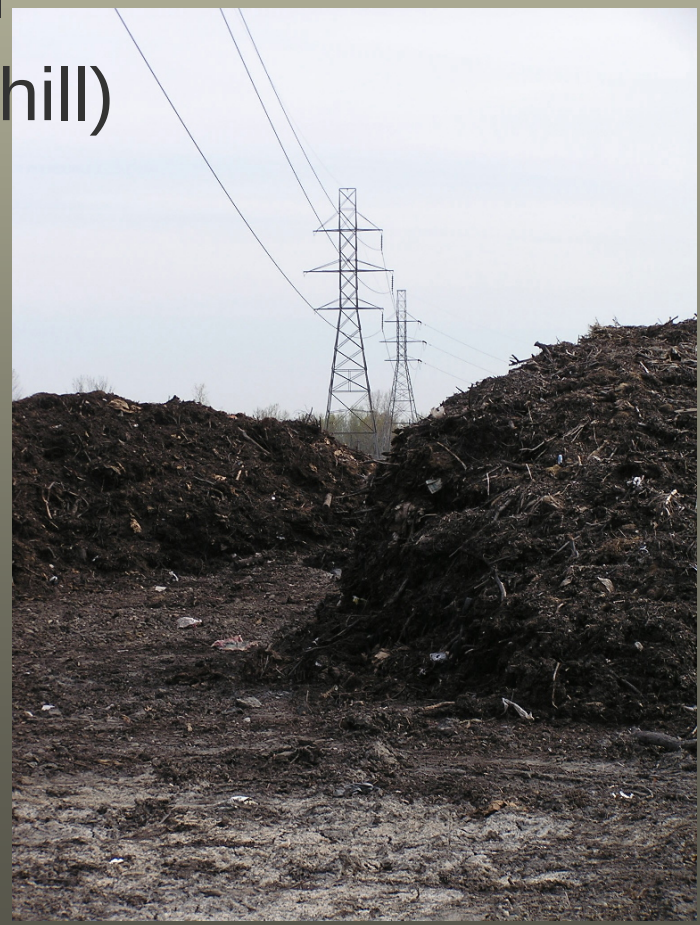
Odor Movement

- ***Very difficult to predict movement***
- ***It can smell worse farther away (on-site ambiance masks the worst odors)***

- ***Prevailing winds rarely prevail***
- ***Hot calm days are toughest***
- ***Beware of temperature inversions***

Topography Matters

- Air follows the path of least resistance
- Odorous air can drain downhill (and it doesn't take much of a hill)



Weather Matters

Odor Control & Management

- A good isolated site
- Good housekeeping
- Prompt handling of feedstocks
- Sensible process management
- Contain or enclose the process
- Capture and treat foul air (e.g. biofilters)
- **Be a good neighbor … generally**

PS: Doug Pinkerton, BioCycle

PS: Scott McCoy

Controlling Dust

- Dampen incoming dry loads
- Maintain moisture
- MIST materials at screens, mixers and grinders
- Hoods over conveyors and other equipment
- Clean air filters in equipment cabs
- Spray roads
- Wind breaks and barriers

Photo Source:Matt Cotton

PS: BioCyle

Other "Nuisances"

- Noise: Maintain equipment, observe time of day restrictions, ear protection for workers and visitors
- Critters: Eliminate puddles, don't stockpile attractive feedstocks, clean tipping area, cover/contain food sources, turn every 5 to 7 days in season (flies)
- Litter: Install perimeter fence, daily housekeeping

Good Neighbor- and Citizen- Ship

Community Relations

- Keep up appearances
- Launch preemptive strikes
- Cultivate friends, many friends
- Cultivate the right friends
- Donate to political campaigns
- Be an asset to the community

Community Relations

- Be sensitive to traffic
- Make your clients sensitive to traffic
- Pick up trash, control dust, minimize noise
- Plant trees
- Don't cut down trees
- Preserve open space
- Follow good practice

Neighbor complaints

- Handle each one seriously
- Communicate
- Take corrective action
- Communicate again
- Regular public relations
- Can be minimized through
  - Site design and planning
  - Visual and noise buffers
  - Sensible hours of operation

QUESTIONS?